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Two New Species of the Genus *Diploproctodaeum* (Trematoda: Lepocreadiidae: Diploproctodaeinae), with Some Comments on Species in the Subfamily Diploproctodaeinae, from Japanese Marine Fishes

Takashi Shimazu

Nagano-ken Junior College, Nagano 380, Japan

ABSTRACT—Two new species of the trematode genus, *Diploproctodaeum* La Rue, 1926 (Lepocreadiidae: Diploproctodaeinae), are described and illustrated from Japanese marine fishes. *Diploproctodaeum hakofugu* sp. n. from the intestine of *Ostracion immaculatus* (Teleostei: Ostraciidae) differs from all the previously known species of the genus and *Diploproctodaeoides soleaticus* Reimer, 1981, chiefly in a much more lobed ovary. *Diploproctodaeum oviforme* sp. n. from the intestine of *Lactoria diaphanus* (Ostraciidae) is separated from the most closely allied species, *D. hakofugu*, chiefly by the ventral sucker being much smaller than the oral sucker and pharynx. Some morphological and systematic comments are given on Japanese species in the subfamily Diploproctodaeinae Park, 1939. *Diploporus* Ozaki, 1928, is reduced to a synonym partly of *Diploproctodaeum* and partly of *Bianium* Stunkard, 1930. *B. holocentri* Yamaguti, 1942, is considered synonymous with *B. hemistoma* (Ozaki, 1928) Yamaguti, 1934.

INTRODUCTION

Shimazu and Nagasawa [1] reported three specimens of a trematode as *Bianium cryptostoma* (Ozaki, 1928) Manter, 1940 [sic] (Lepocreadiidae: Diploproctodaeinae), from *Ostracion immaculatus* from Moroiso Bay, Misaki, Kanagawa Prefecture, Japan. (They gave the host name as "*Lactoria cubicus*" in error). A closer examination of them and additional specimens has shown that the trematode represents a new species of *Diploproctodaeum* La Rue, 1926, in the same subfamily. Another new species of the same genus has also been found out in the course of this study. This paper describes these two new species and incidentally presents some morphological and taxonomic comments on other Japanese species in the subfamily from examination of their museum specimens.

MATERIALS AND METHODS

Two worms were newly obtained from the intestine of *O. immaculatus* taken in Moroiso Bay in July, 1987. They were fixed in Nozawa's fluid without flattening, made into serial paraffin sections (transverse, 15 μm) and stained with Delafield's hematoxylin and eosin. Museum specimens were received already stained and whole-mounted in Canada balsam by various methods. The specimens studied are deposited at the National Science Museum, Tokyo (NSMT), and the Meguro Parasitological Museum (MPM), Tokyo. Measurements (length by width) are given in millimeters unless otherwise stated.

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RESULTS AND DISCUSSION

Diploproctodaeum hakofugu sp. n. (Figs. 1–5)

Bianium cryptostoma
[2] of Shimazu and Nagasawa, 1985 [1], p. 11.

Material studied. All the specimens examined were obtained from the intestine of *Ostracion immaculatus,* as follows.

1) Lot 1. 3 gravid whole-mounts (NSMT-Pl 2878) of *B. cryptostoma* of Shimazu and Nagasawa [1] from Moroiso Bay, Misaki, Kanagawa Prefec-

ture, on July 18, 1983.

2) Lot 2. 2 sectioned gravid worms (NSMT-Pl 3118) from the same locality on July 21, 1987.

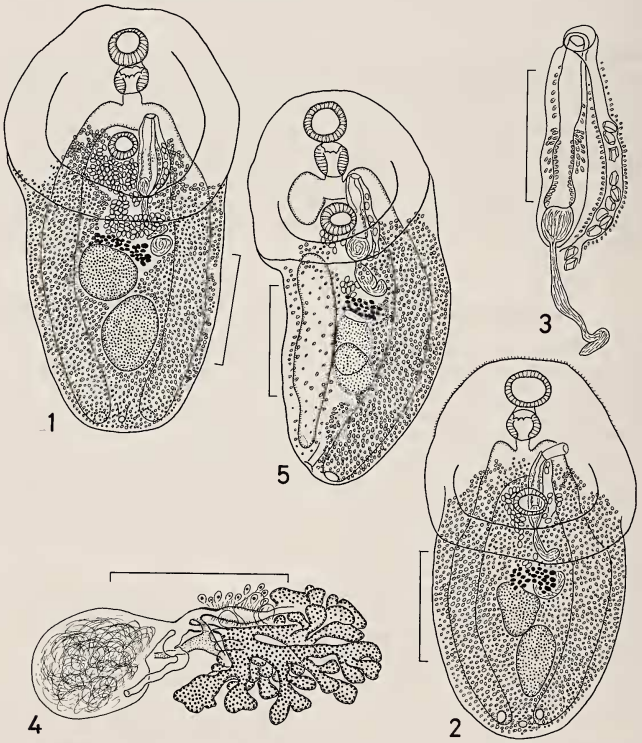
3) Lot 3. 6 gravid whole-mounts (MPM Coll. No. 20469) collected by Kamegai from Kuruwa, Kanagawa Prefecture, on October 3 and November 25, 1984.

4) Lot 4. 5 gravid whole-mounts (MPM Coll. No. 20508) collected by him from the same locality on December 5, 1987.

5) Lot 5. 2 gravid whole-mounts (NSMT-Pl 970) collected by Machida from Nan'yofukaura, Ehime Prefecture, on May 22, 1972.

6) Lot 6. 1 immature and 5 gravid whole-mounts (NSMT-Pl 1509 and 1647) collected by him from Nishidomari, Tsushima, Nagasaki Prefecture, on July 12, 1973, and April 27, 1974.

7) Lot 7. 1 gravid whole-mount (NSMT-Pl



FIGS. 1–5. *Diploproctodaeum hakofugu* sp. n. from *Ostracion immaculatus*. 1. Entire worm, holotype, ventral view. 2. Entire worm, paratype, ventral view, showing more anteriorly distributed vitellaria. 3. Terminal genitalia, holotype, ventral view. 4. Ovarian complex, paratype, dorsal view. 5. Entire worm, paratype, ventral view, showing malformed intestine and vitellaria in right half of body.
(Scale bars: 1 mm in Figs. 1–2 and 5; 0.5 mm in Figs. 3–4.)

1747) collected by him from Tanegashima, Kagoshima Prefecture, on November 24, 1974.

8) Lot 8. 8 gravid whole-mounts (NSMT-Pl 2787) collected by him from Haneji, Okinawa Prefecuture, on May 20, 1983.

9) Lot 9. 2 gravid whole-mounts (NSMT-Pl 3282) collected by him from Owase, Mie Prefecture, on October 13, 1986.

Description. 24 better-prepared gravid whole-mounts measured (Figs. 1–4). Trematoda: Lepocreadiidae: Diploproctodaeinae: *Diploproctodaeum.* Body sometimes truncate on its anterior tip, 2.60–5.80 by 1.20–2.50; anterior glandular portion of body scoop-shaped, with its thick lateral edges united posteriorly, orbicular to ovate, lacking unicellular glands in central part, wider than hindbody, 1.20–2.40 by 1.20–2.90, 38–46% of total body length; forebody 1.04–1.80 long, 26–40% of total body length; hindbody subcylindrical. Tegumental spines minute, seen on ventral side of body anterior to intestinal bifurcation. Eyespot pigments not seen. Oral sucker subterminal, ventral, 0.27–0.51 by 0.28–0.61. Prepharynx short. Pharynx almost as large as oral sucker, 0.21–0.35 by 0.24–0.43, with well-developed circular muscle bearing 8 protuberances at its anterior end. Esophagus short, bifurcating in front of ventral sucker; intestines thick, opening outside through separate, ventral or dorsal ani one on each side of excretory pore. Ventral sucker small, 0.24–0.43 by 0.30–0.47, located at about anterior one-third of body in anterior glandular portion of body; sucker width ratio 1:0.74–0.91 (1:1.11 as an exception); ratio of ventral sucker width to pharynx width 1:0.88–1.00 (1:1.33 as an exception).

Testes almost entire, a little diagonal, close together or slightly overlapping, in middle one-third of hindbody; anterior one globular to somewhat elongated, 0.51–0.86 by 0.43–0.79; posterior one usually longitudinally elongated, 0.67–1.02 by 0.35–0.71. Cirrus pouch club-shaped, thin-walled, 0.61–1.20 by 0.12–0.23, extending midway between ventral sucker and ovary; internal seminal vesicle ellipsoidal, 0.08–0.39 by 0.08–0.23; pars prostatica claviform, elongated, possibly bipartite (proximal portion with more finely granular internal cells; and distal, with more coarsely); a short duct surrounded by larger gland cells present between pars prostatica and ejaculatory duct; ejaculatory duct and cirrus thick, about half as long as cirrus pouch, protrusible; external seminal vesicle curved, reaching ovary, lying free in parenchyma. Genital atrium small, shallow. Genital pore ventral to shoulder of left intestine. Ovary deeply multilobed (or almost multibranched, counted to as many as 60–80 lobes in some specimens), compactly massed, median, immediately pretesticular, wider than long, 0.16–0.59 by 0.31–0.94. Seminal receptacle oval, sinistral to sinistrodorsal to ovary, 0.23–0.47 in diameter. Laurer's canal running backward, opening dorsal to seminal receptacle. Ootype-complex anterodorsal to dorsal to ovary. Uterus arranged in a few intercecal folds, preovarian; metraterm well-developed, surrounded by small gland cells, almost as long as cirrus pouch, 0.55–0.79 long. Eggs many, thin-shelled, operculate, not embryonated, 60–74 by 38–50 μm (slightly collapsed) in balsam. Vitelline follicles small, filling all available space (even over testes and seminal receptacle) in hindbody, usually distributed anteriorly to level of ventral sucker and separated anteriorly, or rarely reaching to bifurcall level and confluent anteriorly. Excretory vesicle tubular, extending to near bifurcal level; excretory pore postero-ventral or -dorsal.

Type host. Ostracion immaculatus (Teleostei: Ostraciidae).

Site of infection. Intestine.

Localities. Moroiso Bay, Misaki, Kanagawa Prefecture (type locality); Kuruwa, Kanagawa Prefecture; Owase, Mie Prefecture; Nan'yofukaura, Ehime Prefecture; Nishidomari, Tsushima, Nagasaki Prefecture; Tanegashima, Kagoshima Prefecture; and Haneji, Okinawa Prefecuture.

Specimens. NSMT-Pl 2878 (holotype); and NSMT-Pl 970, 1509, 1647, 1747, 2787, 2878, 3118 and 3282, and MPM Coll. Nos. 20469 and 20508 (30 paratypes).

Remarks. One specimen of lot 4 had a teratological variation in the intestine (Fig. 5). The right intestinal trunk was partly broken off immediately after descending from the shoulder. The vitelline follicles in the right half of the body were poorly developed and thinly distributed. These anomalies may be unrelated to injury.

Discussion. This trematode belongs in *Diplo-*

proctodaeum La Rue, 1926 [3], because (1) the anterior glandular portion of the body is scoop-shaped with its thick lateral folds united posteriorly; (2) the intestines with no blind anterior process open outside through respective ani; (3) the ventral sucker is simple; (4) the testes are only slightly oblique; (5) the genital pore is just bifurcal; (6) the ovary is pretesticular; and (7) the vitellaria are abundant, filling the hindbody.

Diploproctodaeum consists of seven species: *D. haustrum* (MacCallum, 1919) La Rue, 1926 (type species) [3]; *D. cryptostoma* (Ozaki, 1928) Sogandares-Bernal et Hutton, 1958 [4]; *D. longipygum* Oshmarin, Mamaev et Parukhin, 1961 [5], or *Diploproctodaeoides l.* (Oshmarin *et. al.,* 1961) Reimer, 1981 [6]; *D. macracetabulum* Oshmarin *et al.,* 1961 [5], or *Diploproctodaeoides m.* (Oshmarin *et al.,* 1961) Reimer, 1981 [6]; *D. ghanensis* [sic] (Fischthal et Thomas, 1970) Nasir, 1976 [7]; *D. plataxi* Mamaev, 1970 [8], or *Diploproctodaeoides p.* (Mamaev, 1970) Reimer, 1981 [6]; and *D. chelonodoni* Parukhin, 1979 [9]. *Diploproctodaeum hakofugu* sp. n. is different from *D. haustrum* [6, 10, 11], *D. cryptostoma* [12, this paper] and *D. macracetabulum* [5] mainly in having the ventral sucker being distinctly smaller than the oral sucker and pharynx and the ovary being much more lobate. This new species appears most closely similar to *D. ghanense* out of the other four, but differs from it [13, 14] in a much larger body, tegumental spines confined to the prebifurcal part of the body instead of distributed posteriorly to the testicular region, and a much more lobed ovary (15–18 lobes in *D. ghanense* [14]). If the lateral folds of the anterior glandular portion of the body are separated posteriorly in *D. ghanense* (see below), this characteristic readily distinguishes it from the new species. The much more lobed ovary separates the new species from the remaining three [5, 8, 9]. Furthermore, the new species is different from *Diploproctodaeoides soleaticus* Reimer, 1981 [6], in the ventral sucker being smaller than the oral sucker and pharynx, more posteriorly located testes, a much longer cirrus pouch, a much more lobed ovary and larger eggs. The new species is named after the Japanese name of the host fish.

Ozaki's collection deposited at the MPM, Tokyo, includes three gravid whole-mounts (MPM Coll. No. 30014) obtained from *O. immaculatus* from Goza, Mie Prefecture (other dada not given). These are also assigned to the new species.

Diploproctodaeum oviforme sp. n.
(Fig. 6)

Material studied. 3 gravid whole-mounts (NSMT-Pl 1688) collected by Machida from the intestine of *Lactoria diaphanus* from Tanegashima, Kagoshima Prefecture, on November 9, 1974.

Description. 3 gravid whole-mounts measured (Fig. 6). Similar to the foregoing species in morphology. Body oval to oblong, 2.40–2.90 by 1.10–2.00; anterior glandular region of body scoop-shaped, small, not prominent, slightly narrower than hindbody, 1.10–1.70 by 1.00–1.70, 46–58% of total body length; forebody 0.90–1.26 long, 37–43% of total body length. Tegumental spines not seen. Eyespot pigments not seen. Oral sucker large, 0.31–0.43 by 0.39–0.47. Prepharynx short. Pharynx large, 0.27–0.33 by 0.34–0.55, with well-developed circular muscle bearing 8 protuberances. Esophagus short. Ventral sucker small, 0.21–0.27 by 0.27–0.33; sucker width ratio 1:0.70–0.71; ratio of ventral sucker width pharynx width 1:0.59–0.81.

Testes subglobular, slightly diagonal; anterior one 0.31–0.35 by 0.35–0.40; posterior one 0.51–0.63 by 0.32–0.40. Cirrus pounch 0.47–0.79 by 0.24–0.27; internal seminal vesicle 0.16–0.20 long; pars prostatica club-shaped, 0.11–0.20 long; ejaculatory duct and cirrus 0.20–0.43 long; external seminal vesicle 0.40–0.55 long. Genital pore bifurcal, median in holotype, but sinistrosubmedian in 2 paratypes. Genital atrium not seen. Ovary multibranched, 0.20–0.24 by 0.31–0.71. Seminal receptacle elliptical, 0.31 by 0.18–0.20. Laurer's canal running posteriorly. Metraterm 0.51–0.95 long. Eggs 60–64 by 40–46 μm (a little collapsed) in balsam. Vitelline follicles small, distributed anteriorly to level of ventral sucker. Excretory vesicle not worked out; excretory pore posteroventral or -dorsal.

Type host. *Lactoria diaphanus* (Ostraciidae).

Site of infection. Intestine.

Type locality. Tanegashima, Kagoshima Pre-

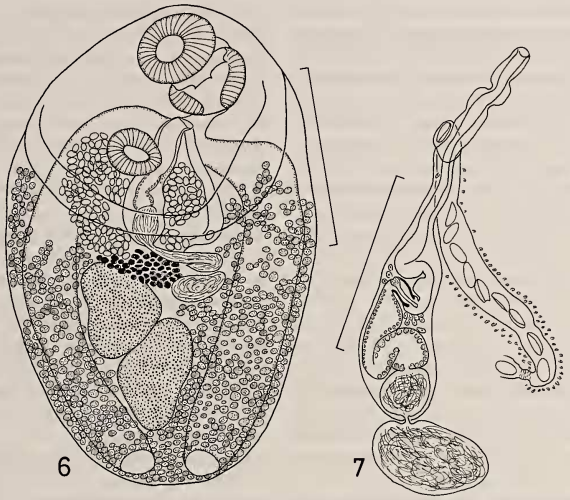


Fig. 6. *Diploproctodaeum oviforme* sp. n. from *Lactoria diaphanus*, entire worm, holotype, ventral view.
Fig. 7. *Bianium hemistoma* (Ozaki, 1928) Yamaguti, 1934, from *Takifugu vermicularis*, terminal genitalia, ventral view.
(Scale bars: 1 mm in Fig. 6; 0.5 mm in Fig. 7.)

fecture.

Specimens. NSMT-Pl 1688 (holotype and 2 paratypes).

Discussion. Diploproctodaeum oviforme sp. n. is closest to the foregoing species but distinguishable from it mainly by the ventral sucker being much smaller than the oral sucker and pharynx, a smaller body and a smaller anterior glandular portion of the body.

Japanese species in the subfamily Diploproctodaeinae

Systematic discussion. The subfamily Diploproctodaeinae Park, 1939 [15], comprizes eight genera: *Diploproctodaeum* La Rue, 1926 [3]; *Bianium* Stunkard, 1930 [16]; *Diplocreadium* Park, 1939 [15]; *Anterovitellosum* Gupta, 1967 [17]; *Caecobiporus* Mamaev, 1970 [8]; *Diploproctia* Mamaev, 1970 [8]; *Cotylocreadium* Madhavi, 1972 [18]; and *Diploproctodaeoides* Reimer, 1981 [6]. The following is a discussion on *Diploproctodaeum* and *Bianium*. The validity of the six others also seems to need studying critically.

Sogandares-Bernal and Hutton [4] concluded that there is not a single character to distinguish *Bianium* from *Diploproctodaeum* and so these two genera are generically identical, after they compared MacCallum's [10] type material of *Diploproctodaeum haustrum* (type species) [3] with their material of *Bianium plicitum* (Linton, 1928) Stunkard, 1931 (type species) [19]. Besides, they declared that the two species (*D. hemistoma* Ozaki, 1928, and *D. cryptostoma* Ozaki, 1928) in *Diploporus* Ozaki, 1928 [12], are congeneric with *D. haustrum*. Stunkard [19] stated that (1) *Bianium* differs from *Diploporus* in shape and proportions of the body; (2) in *Diploporus* the ventrally curved sides of the anterior glandular portion of the body are continued medially to form a conspicuous fold,

similar to that of *Diploproctodaeum,* but such a structure is not present in *Bianium*; (3) the suckers are closer together in *Bianium* and the preacetabular portion of the body is relatively much smaller; (4) in *Bianium* the testes are not situated so obliquely as in *Diploporus,* and in fully mature worms they are distinctly lobed; and (5) the vitelline follicles and the seminal receptacle are much larger in *Bianium.* La Rue [3] defined the anterior glandular portion as spoon- or scoop-shaped in *D. haustrum.* When he erected a new genus, *Diploporus,* for the two new species, Ozaki [12] described and illustrated the portion as shovel- or scoop-shaped in the generic diagnosis and *D. hemistoma.* He said that this genus differs from *Diploproctodaeum* in the oblique position of the testes, the shape of the ovary and the submedian position of the genital pore. Later, Yamaguti [20] indicated that in his own material of *D. hemistoma,* the lateral edges of the portion turn ventrad and approach each other but do not fuse at all. According to him [11, 20], *Diploporus* and *Bianium* are synonyms, and the proper generic name is *Bianium* because *Diploporus* is preoccupied. I think that the morphology of the portion can safely separate these three genera from one another. It seems that the above mentioned other features [12, 19] offer less important generic differences. Some authors [21] have taken it into consideration whether the vitellaria commence anteriorly at the level of or behind or in front of the ventral sucker. This anterior limit, however, varying largely even in a single species (see this paper), is probably of no generic significance.

I consider that *Diploproctodaeum* and *Bianium* are similar but distinct: In the former, the lateral folds of the anterior glandular portion of the body are united posteriorly; but in the latter, separated. The present study has shown that the lateral folds are fused in *D. cryptostoma,* but separated in *D. hemistoma* (see below). *Diploporus* [12] is synonymous partly with *Diploproctodaeum* and partly with *Bianium.* The combinations, *Diploproctodaeum cryptostoma* (Ozaki, 1928) Sogandares-Bernal et Hutton, 1958 [4], and *Bianium hemistoma* (Ozaki, 1928) Yamaguti, 1934 [20], for the two species are accepted.

Reimer [6] created *Diploproctodaeoides* for *Diploproctodaeum longipygum* Oshmarin *et al.,* 1961 [5] (type species), and other three species (see above). He distinguished this genus from *Diploproctodaeum* by the anterior glandular portion of the body with a thick edge being flattened and only slightly raised above the flat hindbody, the esophagus being short or absent, and the ovary being lobed or follicular (in his new species, *D. soleaticus,* with 10 to 12 follicles). In the case of *D. haustrum,* the ovary is said to be entire [10, Fig. 47] to variously lobed (7 gravid whole-mounts of Yamaguti [11], MPM Coll. No. 15088; [22]). These two genera are possibly synonyms. Nasir's [7] combination, *D. ghanensis,* for *B. ghanensis* [13], seems to be problematical, because it has not yet been clarified whether the lateral folds are united or separated posteriorly in this species. The description on them (fused) by Fischthal and Thomas [13] is inconsistent with that (may or may not be united) by Nasir and Gomez [14].

From Japanese waters have so far been recorded the following five species of two genera in the subfamily Diploproctodaeinae.

1. Genus ***Bianium*** Stunkard, 1930

Bianium Stunkard, 1930 [16], p. 363 (type species, *Psilostomum plicitum* Linton, 1928 [19]).
Diploporus Ozaki, 1928 [12], preoccupied, partim, pp. 24–25 (type species, *D. hemistoma* Ozaki, 1928, by subsequent designation).
Diploporetta Strand, 1942 [23], renamed, partim, p. 387 (type species, not designated).
Amarocotyle Travassos, Freitas et Bührnheim, 1965 [24], p. 70 (type species, *A. simonei* Travassos *et al.,* 1965).

1-1. ***B. hemistoma*** (Ozaki, 1928) Yamaguti, 1934 (Fig. 7)

Diploporus hemistoma Ozaki, 1928 [12], pp. 25–29, figs, 13–15.
Bianium hemistoma: Yamaguti, 1934 [20], pp. 525–526.
Bianium holocentri Yamaguti, 1942 [25], pp. 357–359, fig. 14.
Diploporetta hemistoma: Strand, 1942 [23], p. 387.
Bianium hemistomum: Manter, 1947 [26], p. 280.
Diploproctodaeum hemistoma: Sogandares-Bernal and Hutton, 1958 [4], p. 566.
Diploproctodaeum holocentri: Sogandares-Bernal and Hutton, 1958 [4], p. 566.

Material studied. 1) Lot 1. 17 gravid whole-

mounts of "*Maculifer*" from *Takifugu pardalis* (= *Spheroides p.*) (Teleostei: Tetraodontidae) and 3 sectioned gravid specimens of "*Hemistomum*" (unpublished?, MPM Coll. No. 30016) in Ozaki's collection (other data not given).

2) Lot 2. 1 gravid whole-mount of *B. hemistoma* (MPM Coll. No. 22212) of Yamaguti [20] from the intestine of *Spheroides* sp. from Tokoname (Ise Bay), Aichi Prefecture, on April 19, 1929.

3) Lot 3. 2 immature whole-mounts (MPM Coll. No. 22208) in Yamaguti's collection from the intestine of *T. pardalis* from Hamajima, Mie Prefecture on April 14, 1941. (These were identified as *Bianium* on the label by Sh. Kamegai on April 19, 1972).

4) Lot 4. 6 gravid whole-mounts (MPM Coll. No. 22206) of *B. hemistoma* in the same collection from the intestine of *Spheroides* sp. from Shibukawa (prefecture unkown) on April 29, 1957.

5) Lot 5. 1 gravid whole-mount (NSMT-Pl 2879) of *B. hemistoma* of Shimazu and Nagasawa [1] from the intestine of *T. pardalis* from Moroiso Bay on October 16, 1978.

6) Lot 6. 26 immature and 35 gravid whole-mounts (NSMT-Pl 3119–3120) collected by Ogawa from the intestine of the same species of fish from Hagi, Yamaguchi Prefecture, on May 20 and 22, 1986.

7) Lot 7. 3 immature and 6 gravid whole-mounts (NSMT-Pl 3121) collected by him from the intestine of the same species of fish from Nomo, Nagasaki Prefecture, on June 18, 1986.

8) Lot 8. 18 gravid whole-mounts (NSMT-Pl 3123) collected by him from the intestine of *T. poecilonotus* from Nomo on June 19, 1986.

9) Lot 9. 3 immature and 41 gravid whole-mounts (NSMT-Pl 3122) collected by him from the intestine of the same species of fish from Hagi on April 21, 1987.

10) Lot 10. 6 immature and 87 gravid whole-mounts (NSMT-Pl 3124–3126) collected by him from the intestine of *T. vermicularis* from Hagi on May 20–21, 1986, and April 21, 1987.

11) Lot 11. 8 immature and 10 gravid whole-mounts (MPM Coll. No. 22205) of *B. hemistoma* in Yamaguti's collection from *T. niphobles* from Tokoname on April 15, 1941.

12) Lot 12. 1 gravid whole-mount (NSMT-Pl 3127) collected by Ogawa from the intestine of the same species of fish from Hagi on April 22, 1987.

13) Lot 13. 11 (9 whole-mounted and 2 sectioned) gravid specimens (NSMT-Pl 3128–3129) found in the intestine of the same species of fish from Moroiso Bay on July 22–23, 1987.

14) Lot 14. 1 gravid whole-mount (MPM Coll. No. 22213) of *B. hemistoma* in Yamaguti's collection from the intestine of *Stephanolepis cirrhifer* (Monacanthidae) from Tarumi, Hyogo Prefecture, on August 27, 1936.

15) Lot 15. 24 gravid whole-mounts (NSMT-Pl 1013) collected by Machida from the intestine of the same species of fish from Nan'yofukaura on May 25, 1972.

16) Lot 16. 1 gravid whole-mount (holotype and only specimen, MPM Coll. No. 22207) of *B. holocentri* of Yamaguti [25] from the intestine of *Holocentrus spinosissimus* [=*Adioryx s.*] (Holocentridae) from Tokushima, Tokushima Prefecture, on July 5, 1940.

Description. Ozaki [12] published a full description of this species. He described and illustrated the anterior glandular portion of the body as dilated and shovel- or spoon-shaped. However, Yamaguti [11, 20, 27] pointed out that the lateral edges of the portion are completely separated posteriorly from each other, which has been confirmed by the present examination. The following concerns lots 1–15. Fine eyespot pigments were dispersed on each side of the pharynx. The oral sucker was always smaller than the ventral sucker, the sucker width ratio being 1:1.31–1.80. In a few specimens of lot 10, a considerable atrophy was seen in either one or both testes, and the male terminal duct and cirrus pouch were lacking in their anterior parts in one specimen. Shimazu and Nagasawa's [1] pluglike structure was present in the sheathlike proximalmost part of the ejaculatory duct in all the specimens examined with a few exceptions (Fig. 7). The pars prostatica was elastic and appeared to be bipartite: The proximal portion had more finely granular internal cells; and the distal, more coarsely. The male terminal duct (ejaculatory duct and cirrus) was long, invaginating or evaginating, and sometimes much convoluted. The vitelline follicles were distributed anteriorly to the ventral sucker zone in most of the

specimens examined; but in some specimens of lots 5, 9 and 13, they extended anteriorly farther than it along each side of the ventral sucker to almost the pharyngeal level and occasionally were confluent in front of the ventral sucker. Eggs measured 60–76 by 32–47 μm in balsam. Lot 16 was described in detail by Yamaguti [25]. The present reexamination has shown that in it, the pluglike structure is present as well, and the male terminal duct is a little shorter and more straight than in the others.

Discussion. Ozaki [12] described this species from the intestine of *S. pardalis* from Takamatsu, Kagawa Prefecture. He deposited the holotype (No. p. 283) at the Zoological Institute, Science Faculty, Tokyo Imperial University, but most presumably it has already been lost. It is uncertain whether lot 1 is part of the type material. Yamaguti [20] obtained the species (lot 2) from the intestine of various species of *Spheroides* from Mutu, Toyama and Ise bays and the Inland Sea. Later, he [27] briefly described it from *S. pardalis* (other data not given). His specimens have not yet been specified. Shimazu and Nagasawa [1] recorded it (lot 5) from the same species of fish from Moroiso Bay, Misaki.

Ozaki [12] described the vitelline follicles as commencing from the level of the genital pore (or just behind the ventral sucker). Yamaguti [27] observed that they begin in the ventral sucker zone in the majority of cases, and occasionally a little in front of it. He [25] proposed a new species, *B. holocentri* (lot 16), distinguishing it from the most closely related species, *B. hemistoma*, by the anterior extent of the vitellaria (reaching anteriorly to the pharyngeal level, Fig. 14, instead of to the ventral sucker level [12]) and the egg size (66–72 by 39–42 μm instead of 74–81 by 48–52 μm [12]). Stating that no differential character can be found in the anterior extent of the vitellaria between *B. holocentri* and *B. hemistoma* and that the egg size is very variable in other species of *Bianium,* Caballero *et al.* [28] considered that *B. holocentri* is synonymous with *B. hemistoma.* According to Sogandares-Bernal and Hutton [29] and Gupta [30], however, *B. holocentri* is valid, and they [28] apparently confused the anterior parenchymal gland cells figured by Ozaki [12] with the vitelline follicles. The sucker width ratio is 1:1.87 (calculated from Yamaguti [25] in *B. holocentri.* In *B. hemistoma,* the ratio is 1:1.31–1.80 (this paper); the eggs are 66–72 by 33–39 μm in life [27] and 60–76 by 32–47 μm in balsam (this paper); and sometimes the vitellaria extend anteriorly as far as the pharyngeal level and are confluent in front of the ventral sucker (this paper). The male terminal duct in *B. holocentri* is a little shorter and more straight than in *B. hemistoma.* These differences are very slight. I concur with Caballero *et al.* [28] in reducing *B. holocentri* to a synonym of *B. hemistoma.*

2. Genus ***Diploproctodaeum*** La Rue, 1926

Diploproctodaeum La Rue, 1926 [3], p. 208 (type species, *Hemistomum haustrum* MacCallum, 1919 [3].
Diploporus Ozaki, 1928 [12], preoccupied, partim, pp. 24–25 (type species, *D. hemistoma* Ozaki, 1928, by subsequent designation).
Diploporetta Strand, 1942 [23], renamed, partim, p. 387 (type species, not designated).

2-1. ***D. cryptostoma*** (Ozaki, 1928) Sogandares-Bernal et Hutton, 1958

Diploporus cryptostoma Ozaki, 1928 [12], pp. 30–32, figs. 16–17.
Bianium cryptostoma: Yamaguti, 1934 [20], pp. 525–526; Manter, 1940 [2], p. 377.
Diploporetta cryptostoma: Strand, 1942 [23], p. 387.
Bianium cryptostomum: Manter, 1947 [26], p. 280.
Diploproctodaeum cryptostoma: Sogandares-Bernal and Hutton, 1958 [4], p. 566.

Material studied. 1) Lot 1. 17 gravid whole-mounts of "*Diploproctodaeum*" and 3 sectioned gravid specimens of "*Hemistomum*" (unpublished?, MPM Coll. No. 30015) in Ozaki's collection (other data not given).

2) Lot 2. 2 sectioned gravid specimens (unpublished, MPM Coll. No. 22209) of *B. cryptostoma* in Yamaguti's collection from the intestine of *Spheroides* sp. on October 14 and 24, 1936 (locality not given).

3) Lot 3. 1 or 2 sectioned gravid specimens (unpublished, MPM Coll. No. 22210) of *B. cryptostma* in the same collection from the intestine of *Spheroides* sp. from Maisaka, Shizuoka Prefecture, on April 12 (year not given).

4) Lot 4. 4 gravid whole-mounts (unpublished,

MPM Coll. No. 22211) of *B. cryptostama* in the same collection from the intestine of *Canthigaster rivulata* (Tetraodontidae) from Katase, Kanagawa Prefecture, on June 7, 1958.

Description. The present examination has verified Ozaki's [12] observation that the lateral edges of the anterior glandular portion of the body are united posteriorly. The following supplements his original description: fine eyespot pigments dispersed in forebody; prepharynx short; oral sucker usually slightly larger than ventral sucker; sucker width ratio 1:0.9–1.09; esophagus short; internal seminal vesicle elliptical; pars prostatica globular; pluglike structure absent in proximal part of ejaculatory duct; ejaculatory duct and cirrus thick, straight, protrusible; genital pore sinistrosubmedian, bifurcal or a little posterior to it; ovarian lobes numbering to about 30; eggs in uterus measuring 67–80 by 40–47 μm in balsam; and vitellaria distributed anteriorly to ventral sucker level to midpharyngeal level, may or may not be confluent in front of ventral sucker.

Discussion. This species has previously been described as *Diploporus cryptostoma* only once by Ozaki [12] from egg-bearing worms found in the intestine of *Spheroides pardalis* from Takamatsu, Kagawa Prefecture. He missed the egg size out of his description. According to him, the species was found together with *B. hemistoma,* but much less frequently, in the fish. Most probably the holotype (No. p. 284) deposited by him at the Zoological Institute, Science Faculty, Tokyo Imperial University, has already been lost. It is uncertain whether lot 1 is the component of the type series. Shimazu and Nagasawa's [1] trematode of *B. cryptostoma* has been described as a new species (see above).

Yamaguti evidently obtained the trematode that he identified as *B. cryptostoma* at least once as lete as 1936 and subsequently at least twice. Nevertheless he did not mention a word about this species in his publications somehow. The combination for the species, *B. cryptostoma*, which Manter [2] used as well, is due to Yamaguti [20], because he first made *Diploporus* a synonym of *Bianium*.

In this species the lateral edges of the anterior glandular portion of the body are united posteriorly. I agree with Sogandares-Bernal and Hutton [4] who transferred the species from *Diploporus* to *Diploproctodaeum* as *D. cryptostoma* (Ozaki, 1928). Manter [26] listed a new combination, *B. cryptostomum* (Ozaki, 1928), for the species, which accordingly is untenable.

2-2. ***D. hakofugu*** sp. n.
See this paper.

2-3. ***D. oviforme*** sp. n.
See this paper.

2-4. ***Diploproctodaeum*** sp. of Machida (1986)
Machida [31] obtained this trematode from the intestine of *Aluterus monoceros* and *A. scriptus* (Monacanthidae) from southern Japanese waters. He assumed it to be *D. haustrum*. It may possibly be that he had more than one species. There has not yet appeared a full description of the trematode.

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